

RESEARCH ARTICLE

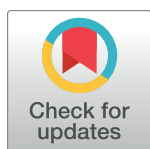
# Quality circles for quality improvement in primary health care: Their origins, spread, effectiveness and lacunae— A scoping review

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## Abstract

Quality circles or peer review groups, and similar structured small groups of 6–12 health care professionals meet regularly across Europe to reflect on and improve their standard practice. There is debate over their effectiveness in primary health care, especially over their potential to change practitioners' behaviour. Despite their popularity, we could not identify broad surveys of the literature on quality circles in a primary care context. Our scoping review was intended to identify possible definitions of quality circles, their origins, and reported effectiveness in primary health care, and to identify gaps in our knowledge. We searched appropriate databases and included any relevant paper on quality circles published until December 2017. We then compared information we found in the articles to that we found in books and on websites. Our search returned 7824 citations, from which we identified 82 background papers and 58 papers about quality circles. We found that they originated in manufacturing industry and that many countries adopted them for primary health care to continuously improve medical education, professional development, and quality of care. Quality circles are not standardized and their techniques are complex. We identified 19 papers that described individual studies, one paper that summarized 3 studies, and 1 systematic review that suggested that quality circles can effectively change behaviour, though effect sizes varied, depending on topic and context. Studies also suggested participation may affirm self-esteem and increase professional confidence. Because reports of the effect of quality circles on behaviour are variable, we recommend theory-driven research approaches to analyse and improve the effectiveness of this complex intervention.

## Introduction

Quality circles (QCs) or peer review groups, and other similar small groups of health care professionals meet regularly across Europe to reflect on and improve their standard practice. QCs

**Competing interests:** The authors report no conflicts of interest. AR works as a general practitioner at medbase Health Care Centres, a network providing primary health care services in Switzerland. As a member of the committee for quality improvement in the Swiss Society of General Internal Medicine, he supervises and trains facilitators. GW, SM, KT, and JH independently contributed their academic and methodological experience to this project. This does not alter our adherence to PLOS ONE policies on sharing data and materials.

are rooted in two fundamental concepts that shaped them from the beginning: the framework of the Plan-Do-Check-Act cycle, and the social context in which the group functions [1]. QCs use didactic methods like brain-storming and reflective thinking, and quality improvement (QI) techniques like audit and feedback or purposeful use of local experts. In several European countries, QCs support quality initiatives in primary health care (PHC) [2–11], as in Scotland and Wales, where structured small groups for QI were introduced to replace a pre-existing outcomes-driven incentive scheme [12, 13]. Many techniques QCs employ have been systematically reviewed but it is not clear if these techniques (alone or in combination) improve the practice of participants. This scoping review was intended to help us define QCs, describe their origin and intentions, explore their effectiveness in the context of PHC, and identify areas where there are gaps in our knowledge.

## Methods

### Method of the scoping search

Unlike systematic reviews, which are based on strictly defined research problems, scoping reviews usually address broadly formulated questions. They map literature on a broad topic to identify and describe studies, to look for definitions and identify and describe key concepts [14]. This approach relies on stepwise and iterative search techniques to develop a strategy to retrieve adequate literature. Inclusion and exclusion criteria and data extraction templates are not predetermined; instead, they develop gradually in tandem with the search [15, 16]. Scoping reviews do not formally assess the methodological quality of studies or data. They instead cast a broad net, capturing enough papers to begin to answer the broad questions they ask, laying the groundwork for later systematic reviews that can exclude papers of low methodological quality to improve validity [14, 17]. This broad focus allowed us to include and consult selected books and websites to supplement our literature search results [18].

The scoping search was conducted in several steps, following the guidelines for conducting systematic scoping reviews [19]:

- Identify literature on QCs and determine what kind of studies described and defined them;
- Determine the origin of QCs and how they spread;
- Describe their intentions and reported benefits;
- Review their reported effectiveness on behaviour change; and,
- Summarize questions unanswered in the literature.

### Information sources and search

The literature search was carried out by AR, who included all published articles up to December 2017. AR ran a limited search on the term ‘quality circle’ in PubMed to identify the first papers and then collaborated with an experienced librarian to expand the search. Together, they analysed text in the title and abstract and the article’s indexing terms to generate a broader list of terms. Iterative searching revealed descriptive terminology like ‘quality improvement’, ‘group functions’ and ‘primary care’ (S1 File). We retrieved literature from Medline, Embase, PsycInfo, and CINAHL without language or time restrictions and downloaded the citations to Endnote X8.

To check whether and how the definitions and processes described in the literature were implemented, AR searched websites in countries where the literature described active QCs [2–

[11]. If a website was not accessible to the public, AR contacted the authors or organisations to ask for access. AR, SM, and JH compared and discussed information from the literature and from the websites that described the definitions and processes of real-world QCs.

Because background information on underlying intentions, origin, and spread of QCs was scarce in published papers, AR looked for books published in countries where QC activities had been reported, searching in SOLO (Search Oxford Libraries Online: 'quality circle' and 'peer review group'). Because QCs were introduced to PHC in the 1980s, we limited our search to books published after 1980, without language restrictions. We used filters including 'education', 'knowledge management' and 'medical care' to identify candidate books. Since few were available online, AR went to libraries to leaf through tables of contents, and, in consultation with SM and JH, selected those books that described the origin, definition, and processes of QCs. Books were included if they contained information on the origin and intentions of QC and if they described the basic characteristics of PHC QCs. We halted the search when we reached saturation and it was clear additional sources were no longer providing new information. We ultimately included 12 textbooks and used them to verify information retrieved from the literature identified in our database search (S2 File) [20–31].

### Eligibility criteria

We considered for inclusion any paper on QCs within PHC, in any language, with qualitative or quantitative outcomes, or background information. AR screened all papers identified by the search and SM, JH and GW cross-checked them to ensure eligibility criteria were consistently applied.

### Paper selection

We checked only to see if papers provided relevant information about QCs in PHC. AR assessed relevance and then discussed his findings with SM, JH and GW. Papers were relevant if they met criterium A or B:

- A. The paper contained information about the background of QCs in PHC.
- B. The paper described the process in these small groups and contained data to allow to evaluate QCs in PHC.

The flow diagram (Fig 1) shows the number of papers included and excluded at each stage.

### Data collection and reporting

We identified the aspects of the publications specific to study types and categorized them according to the Cochrane Manual [32]:

- randomized controlled trials, whether or not the nature of the intervention made blinding impossible
- non-randomised controlled trials, further grouped into controlled before-and-after studies, interrupted time series, historically controlled studies, cohort studies and case series (uncontrolled longitudinal studies)

AR extracted the following data: authors; publication year and location; descriptions of QC background; definitions of QCs; their underlying processes; their possible effectiveness; historical development; and, their spread. We used this data to generate a narrative and tables that describe the aspects of QCs. In parallel, we generated our data extraction template in Microsoft Excel 2016, taking an incremental approach. We then charted data for each topic, one at a time, to meet our objectives.

# PRISMA Flow Diagram: 28/12/2017

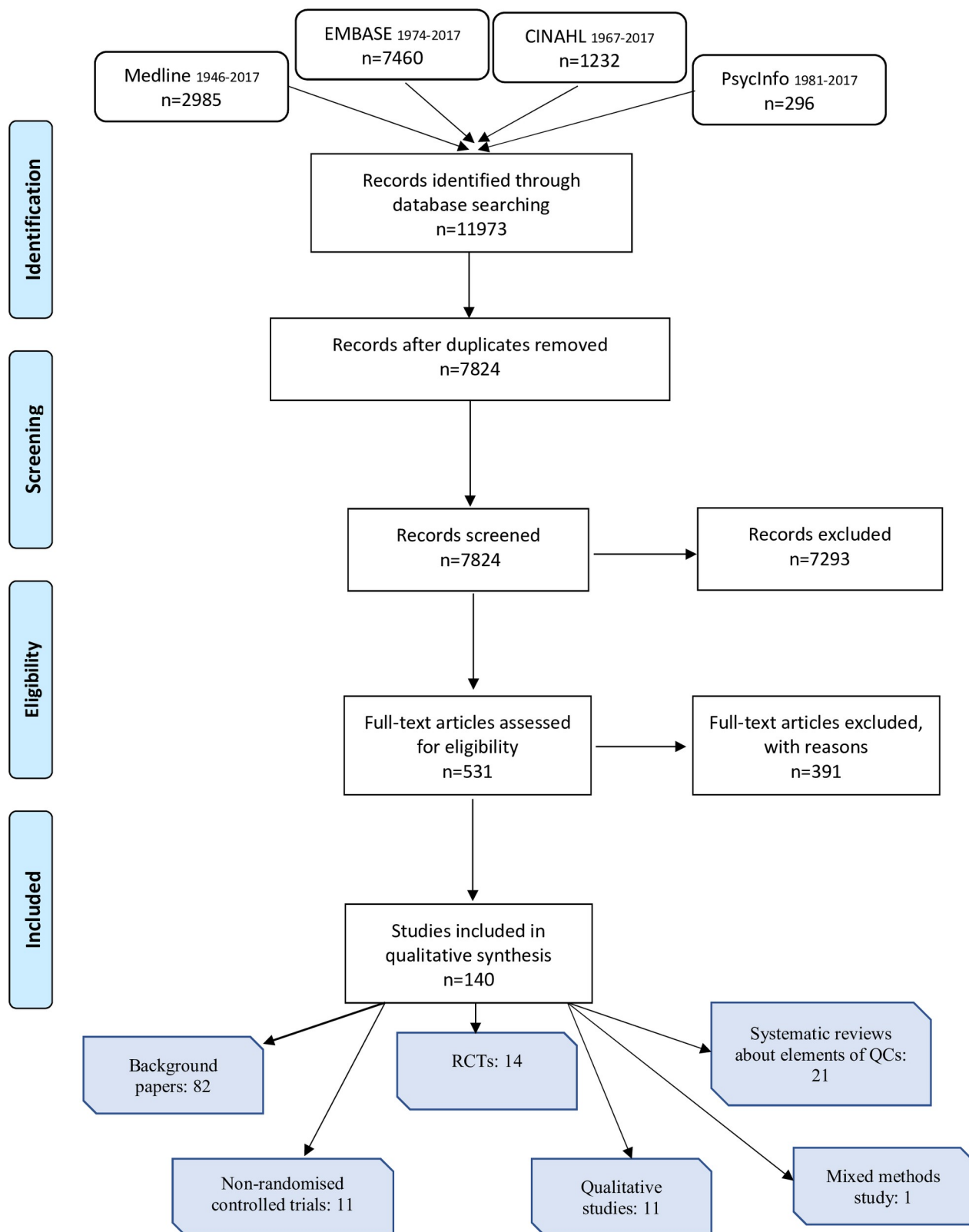


Fig 1. Paper flow diagram.

<https://doi.org/10.1371/journal.pone.0202616.g001>

## Results

Our iterative searches returned 82 background papers (S3 File). Among retrieved papers, we deemed eligible and relevant 21 systematic reviews [33–53], 14 randomised controlled trials [54–67], 11 non-randomised controlled studies [68–78], 11 qualitative studies [79–89], and one mixed methods study [90] (S4 File). The systematic reviews, randomised controlled trials, cohort and controlled before-and-after studies each described and evaluated the processes or techniques QCs used. Qualitative studies and background papers described their processes and additional benefits. Background papers and the books and web resources we identified provided complementary information on the origin, definition, and spread of QCs.

## What quality circles are

We used the included papers to identify concurrent key concepts about QCs. All sources confirmed that QCs comprise small groups of 6–12 health care professionals who meet regularly to reflect on and improve their standard practice [2, 5–7, 9–11, 20, 22–29, 31, 71, 72, 78, 82, 91–97]. The terms Practice Based Small Group Work, Peer Review Group, Problem Based Small Group Learning, Practice Based Research Group, Quality Circle, Continuous Medical Education (CME) Group, and Continuous Professional Development (CPD) Group were used interchangeably and varied among countries. The labels suggest the basic, original intent of the group. We decided to use the umbrella term Quality Circle to describe all of them.

Terms like ‘peer review group’ or ‘*entre pairs*’ reflect the principle of equity in a group without a hierarchy. This group of equals creates a climate of trust that promotes a free speech culture where discussions of everyday problems are founded on collective expertise [10, 25, 95, 98]. It is similar to collegial counselling (intervision), where equals seek to solve an existing problem, e.g., when colleagues draw clinical cases and others help solve them. This is often the starting point for mutual learning [23, 96, 99]. Depending on the country’s tradition, QCs might not be limited to GPs but involve other professionals in PHC, including practice assistants (in the Netherlands and Germany) or practice teams (in Scotland), who add perspectives to the QC process [59, 67, 82, 100–102]. Interprofessional collaboration and mutual learning may also involve practice nurses [103] or specialists invited to QCs to share expertise on a specific topic, e.g., pharmacists who contribute to a discussion on prescription patterns [75, 104, 105].

Autonomy is another important principle [106]. The groups choose a topic they want to learn more about or an aspect of quality that they want to improve in their practice. They decide how to approach and solve the problem, and they create space to reflect on how to improve clinical practice [2, 6, 21, 28, 64, 78, 80, 84, 85, 98, 107–110]. The groups choose their own facilitators, who observe and lead the group through a QI cycle. QCs respect the contribution of each individual. They also consider group dynamics and try to keep members focused without controlling the discussion [25, 28, 43, 47, 79, 89, 111, 112].

QCs combine techniques, including discussing educational material in a workshop-like atmosphere, contact with local experts, auditing and feedback on clinical practice with or without outreach visits, facilitation, and local consensus processes [82, 84, 92, 93, 95, 97, 98, 113–118]. The group may also rehearse clinical skills and use active didactic methods to promote learning, including brain-storming, reflective thinking, self-monitoring and professionally reprocessing patient situations [2, 8, 9, 11, 24, 29, 31, 87].

Techniques and didactic methods are usually tailored to local contexts and circumstances. The number and difficulty of these techniques and didactic methods, and the outcomes and

the context of the group, all affect the process [84, 87, 104]. QCs are therefore complex social interventions [119, 120] that run in PHC systems, constantly changing in response to new economic situations, scientific developments, and cultural pressures. They incorporate social aspects of the workplace that affect team work, self-determination and involvement in management at a day-to-day level.

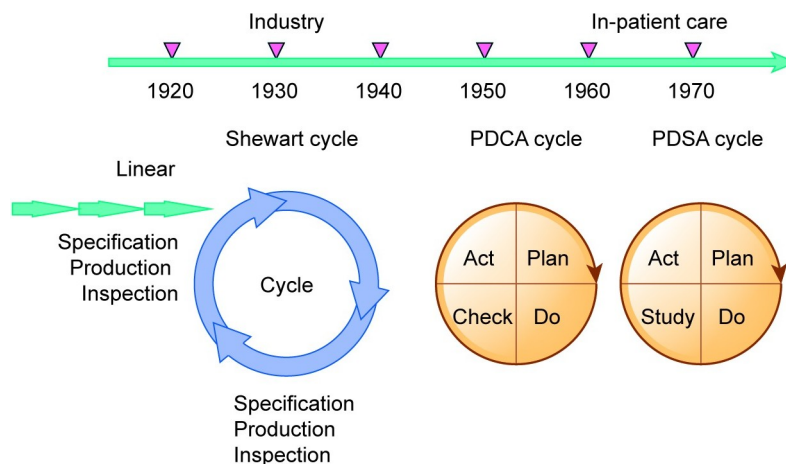
## Origins and spread of quality circles

In 1924, Shewart created a table that depicted a cycle for continuous control of the QI process. Deming improved this model and introduced the Plan-Do-Check-Act cycle (Fig 2) [121]. The model was used by small groups of frontline workers instead of administrators because workers often know how to improve production. The assumption was that if workers volunteered to help develop the organization, they could improve both products and the work environment.

QCs spread first within manufacturing industry, then to the service industry, and finally to the medical sector. [20, 122]. Donabedian adopted the principles of QI to health care where there are also three interdependent quality dimensions: structure, process, and outcome [123]. His model of QI in health care was first implemented in in-patient settings and secondary-care clinics in the Netherlands. The development of QCs in health care was driven by a need for participative group problem-solving approaches and shared responsibility for decision-making in rapidly expanding and expensive health care systems [124]. QCs in PHC originated in two centres: McMaster University in Canada and the University of Nijmegen in the Netherlands. In their undergraduate programmes, both universities promoted Problem Based Learning (PBL), which confronts a group of learners with a problem they have to solve, so they must actively participate in learning about the related issues [125].

In 1974, at McMaster, Premi presented the results of 6 years' experience of GPs who met on a regular basis to exchange thoughts about clinical cases and increase and update their knowledge [126]. This programme mainly addressed GPs' needs for lifelong learning. As teachers, academics and policy makers built networks, the programme spread from McMaster, Canada, to Ireland, Scotland, and England and eventually to the USA, Australia and New Zealand as shown in Fig 3 [3, 7–9, 127].

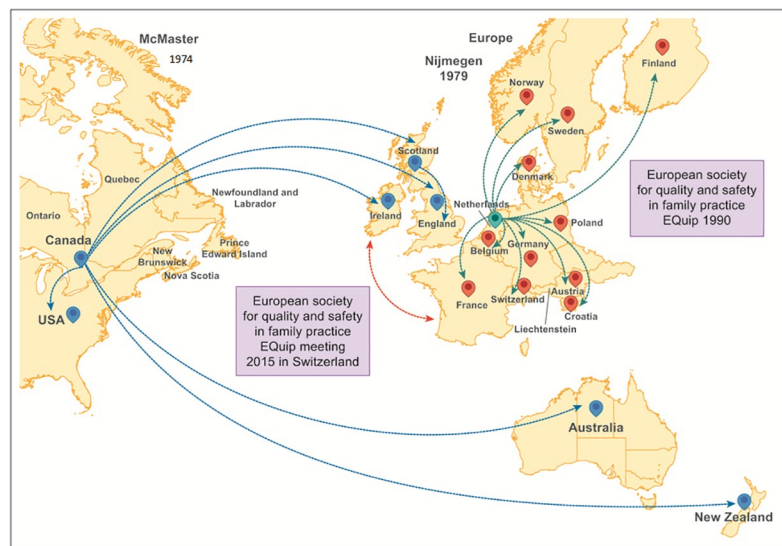
In 1979, at the University of Nijmegen, Netherlands, PBL was implemented experimentally within small groups of GPs who met voluntarily on a regular basis to continuously and



**Fig 2. Development of the quality improvement process.**

<https://doi.org/10.1371/journal.pone.0202616.g002>





**Fig 3. Spread of quality circles.**

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autonomously improve their knowledge through peer interaction [94]. Like Dutch hospitals had adopted Donabedian's dimensions of quality in health care, the Dutch GPs adopted them in their small group work. Gradually, they transformed the learning cycle into a QI cycle, as their focus shifted from learning to improving practice [128, 129]. They combined didactic techniques from PBL with communication skills and understanding of group dynamics from industrial small group work. When the European Society for Quality and Safety in Family Medicine (EQuiP) was founded, it became a communication channel through which developments like QCs were shared. QCs then spread rapidly from the Netherlands to many other European countries (Fig 3) [2–11, 54, 69, 81, 83, 94, 130–135]. In 2015, EQuiP organised a conference in Fischingen, Switzerland, on QCs in PHC where representatives of these very similar movements documented the range of components they used in QCs, characterised their underlying mechanisms, and explored the local context in which they were conducted.

### Intentions and benefits of quality circles

Knowledge and skills acquired during early medical education must be regularly updated through continuous medical education, which helps medical professionals apply new knowledge via continuous professional development [33, 41, 136, 137]. CME and CPD are necessary prerequisites for QI [138–141]. QI is a data-guided activity that improves health care delivery by solving local problems like inefficient, harmful, or badly-timed health care [142, 143]. In some European countries, QCs seem to play a major role in QI; in others, they mainly serve CME and CPD [94].

The qualitative literature and background papers described the benefits of QCs. GPs seem to prefer learning in small groups [85, 103, 107, 140, 144] that help them to link evidence to everyday practice [79], learn to deal with uncertainty [81] and show them how to improve practice and feel secure in their professional roles [84]. QCs are a vehicle for discussing issues and reflecting on practice, which may raise self-esteem [83, 100]. Frequent participation strengthens team-based strategies for preventing errors [86]. When participants talk about their practice performance in groups, this can take them outside their comfort zone, causing anxiety and generating a stress response [83, 145]. But this stress response may improve

communication skills and provide a learning opportunity [88, 89]. Several groups of authors note that working in small groups may help prevent burnout and give general practitioners a sense of belonging that so they changed workplace less often [51, 80, 89, 146–148].

### Reported effectiveness

We assessed 24 quantitative studies and one SR to determine if they claimed QCs promote behaviour change. Authors of four studies that examined guideline adherence reported their positive results had limited validity; four RCTs on the topic showed no effect, so the evidence on behaviour change concerning guideline adherence is not convincing. We found 15 papers, including one that summarized three studies and one SR, that suggest QCs may improve individual and group performance by reducing costs, encouraging professionals to order fewer but more appropriate tests, improving prescription habits, and reporting critical incidents. Reported effectiveness varied substantially within and among studies (Table 1).

SRs and one RCT show that facilitation enabled participants in QCs to introduce changes [43, 47] and that multifaceted interventions, peer review, audit, and feedback reinforce behaviour change [149] (Table 2).

### Summary of unanswered questions on quality circles addressed in the literature

Every author of an SRs that found QC techniques changed behaviour noted considerable variation within and between studies. They could document behaviour change in a SR, but not explain why it happened. SRs and RCTs that studied QC techniques only evaluated the impact or effectiveness of individual techniques but QCs often combine techniques and, in these cases, it is not clear how much each contributes to the overall effect [34, 36, 53].

To determine how and why techniques do or do not work, each step in the intervention process needs to be described in detail [38, 41, 44, 49] so we can evaluate the effectiveness of each step and each intervention, individually and in combination. For example, steps could include combining printed educational material with input from local opinion leaders, CME workshops, or outreach visits [48, 49].

We also need to account for the different contextual features of health care systems, and the roles these features play at each level. For instance, at the group level, professionals with different backgrounds may not all be equally involved in QI. At the institutional level, support for QC groups may vary. At the policy level, not all countries may leave QI to locally organised small groups [150]. We do not yet know which techniques should be used or what circumstances encourage QC participants to change their behaviour [52]. For example, audit and feedback interventions typically produce heterogeneous effects, and we would need to identify the underlying reasons for behaviour change after audit and feedback before we could know when to deliver this intervention, how best to design it, and how to optimise it in routine practice [50].

Small group work succeeds in continuous medical education, but we must ask how and why it could work or fail for quality projects [84]. What resources can small groups offer GPs to support changing their behaviour [73]? What it is about QCs that can improve the clinical performance of GPs? What group factors are crucial to better outcomes [74]. How frequently should group process should be repeated [50, 64, 65]? In their SR, Cadogan et al. argue that future research should be designed to improve our understanding of when, how, and why interventions like education or providing guidelines are likely to be effective and how these interventions can be improved. Such intervention studies should be based on a theory that can explain changes in clinical practice [53].



**Table 1. Effectiveness of quality circles.**

First author/year	Study type	Intervention	Effective
		<b>Guideline adherence improved</b>	
Hartmann 1995 [68]	Controlled before-and-after	Diabetes type 2	(Yes)
Ioannidis 2007 [71]	Case series	Osteoporosis, pilot	(Yes)
Ioannidis 2009 [73]	Interrupted time series	Osteoporosis	Yes
Mahlknecht 2016 [78]	Case series	Chronic diseases	(Yes)
Elward 2014 [7])	controlled before-and-after	Asthma	(Yes)
Goldberg 1998 [54]	Randomised controlled	Hypertension and depression	No
Lagerlov 2000 [55]	Randomised controlled	Asthma and urinary tract infections	Yes
Schneider 2008 [60]	Randomised controlled	Asthma	No
Wilcock 2013 [64]	Randomised controlled	Dementia	No
Jager 2017 [67]	Randomised controlled	Polypharmacy	No
		<b>Prescription quality improved</b>	
Dyrkorn 2016 [77]	controlled before-and-after	for antibiotics	Yes
Welschen 2004 [59]	Randomised controlled	for antibiotics	Yes
Gjelstad 2013 [6]	Randomised controlled	for antibiotics	Yes
Vervloet 2016 [66]	Randomised controlled	for antibiotics	Yes
Rognstad 2013[63]	Randomised controlled	in general, for elderly	Yes
Richards 2003[69]	Historically controlled study	in general	Yes
		<b>Prescription quality improved and/or costs decreased</b>	
Wensing 2004 [70]	controlled before-and-after	prescription quality and costs	Yes
Wensing 2009 [7])	controlled before-and-after	prescription quality and costs	Yes
Niquille 2010 [75]	Cohort	prescription quality and costs	Yes
Riou 2007 [72]	Cohort	prescription costs	Yes
		<b>Test ordering quality improved and/or costs decreased</b>	
Verstappen 2003 [56]	Randomised controlled	test ordering quality	Yes
Verstappen 2004 [57]	Randomised controlled	test ordering quality	Yes
Verstappen 2004 [58]	Randomised controlled	test ordering quality and cost reduction	Yes
		<b>Patient safety improved</b>	
Verbakel 2015 [65]	Randomised controlled	reporting critical incidents	Yes
Zaher 2012 [51]	Systematic review	Behaviour change	Yes

() means that authors report limited validity of the results

<https://doi.org/10.1371/journal.pone.0202616.t001>

## Discussion

### Summary

QCs originated in industry and were implemented in health care after adapting aspects of quality critical for health care. QCs spread rapidly, since group work appears to meet GP expectations about CME, CPD and QI projects. As costs for health care have risen, so has the need for participatory, problem-solving group approaches and for shared responsibility. Reported benefits included giving participating professionals a better understanding of their roles, increasing their self-confidence and preventing burnout. But the reported effect of QCs on behaviour change varies substantially within and across studies, making interpretation of study results difficult.

Table 2. Systematic reviews and randomised controlled trials of techniques used in quality circles.

First author / year	Tool	Study type	Effect
<b>Predisposing</b>			
Davis 1999 [33]	Interactive CME meetings	SR	+
Davis 2006 [37]	Self-assessment	SR	-
O'Brien 2007 [38]	Educational outreach visits	SR	+
Bowie 2008 [39]	Significant event analysis	SR	+ / -
O'Brian 2001, Forsetlund 2009 [35, 41]	Educational meetings and workshops	SR	+
Harris 2011 [45]	Journal club	SR	+ / -
Flodgren 2011 [44]	Local opinion leaders	SR	+
Farmer 2008, Giguere 2012 [40, 48]	Printed educational materials	SR	+ / -
<b>Enabling</b>			
Grimshaw 2012 [49]	Clinical guidelines	SR	+ / -
Dogherty 2010, Baskerville 2012 [43, 47]	Facilitation	SR	++
Baker 2010, Baker 2015 [42, 52]	Tailored interventions	SR	+
Parmelli 2011 [46]	Change in organisational culture	SR	+/-
<b>Reinforcing</b>			
Gill 1999 [34]	Multifaceted interventions to improve prescribing	SR	+
Arnold 2005 [36]	Multifaceted interventions to improve antibiotic prescribing	SR	+
Roberts 2012 [61]	Peer review	RCT	+
Ivers 2012 [50]	Audit and feedback	SR	++
Cadogan 2015 [53]	Multifaceted interventions to improve test ordering	SR	+

+ / —no conclusive evidence

+ small effect

++ significant effect

<https://doi.org/10.1371/journal.pone.0202616.t002>

## Limitations of retrieved papers

Most of the papers we reviewed found QCs had positive effects. This may suggest publication bias or outcome reporting bias [32]. Researcher allegiance could be one of the reasons for outcome reporting bias as it is likely that researchers and participants may have had a special interest in and were favourably disposed towards the QCs they examined. We found only one study that examined the performance of everyday activities of QCs [75], so data were mostly limited to interventions in newly formed groups. In existing QCs, researchers did not usually measure planned change, but performance after an intervention researcher introduced.

## Implications

Since QCs are a non-standardized complex intervention that varies by the topic and context of a group, inconsistent outcomes are unsurprising [151]. Complex interventions are hard to study, but realist approaches like realist review and realist evaluation could help us to make sense of QC outcomes [152–154]. These methods are designed to explain empirical outcomes and not just to quantify effect size. Since why and how QCs work is just as important as whether they can work, we need to understand the theoretical basis of interventions before we can explain why performance differs depending on the context, content, and application of QCs. Theoretical models from other research fields like psychology and sociology could aid this exploration, since these also evolved to analyse complex events and actions in different contexts. We have begun a realist review to fill some of these knowledge gaps [155].

## Strengths and limitations

Our review conforms to standard methods for scoping reviews and summarizes literature in all languages so it can guide future search and research strategies. Consulting varied sources allowed us to cross-check the information we gleaned from the articles. Because scoping reviews do not assess the methodological quality of included studies, our results are suggestive rather than conclusive.

## Conclusion

Quality circles originated in industry and migrated to health care where they meet the demands of general practitioners for continuous medical education, continuous professional development, and quality improvement. Quality circles may positively influence professional role perception and self-esteem, which could explain their broad, international adoption. But reported effects on prescribing behaviour or process changes vary substantially between studies, so we suggest a realist approach to exploring the constituents and contextual features of quality circles that improve performance

## Supporting information

**S1 File. Search strings.**

(DOCX)

**S2 File. Text books.**

(DOCX)

**S3 File. Background papers.**

(DOCX)

**S4 File. Papers examining quality circles.**

(DOCX)

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## Author Contributions

**Conceptualization:** Adrian Rohrbasser, Janet Harris, Sharon Mickan, Kali Tal, Geoff Wong.

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**Funding acquisition:** Adrian Rohrbasser.

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**Project administration:** Adrian Rohrbasser, Geoff Wong.

**Supervision:** Janet Harris, Sharon Mickan, Geoff Wong.

**Validation:** Janet Harris, Sharon Mickan, Geoff Wong.

**Visualization:** Adrian Rohrbasser, Kali Tal.

**Writing – original draft:** Adrian Rohrbasser.

**Writing – review & editing:** Adrian Rohrbasser, Janet Harris, Kali Tal, Geoff Wong.

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